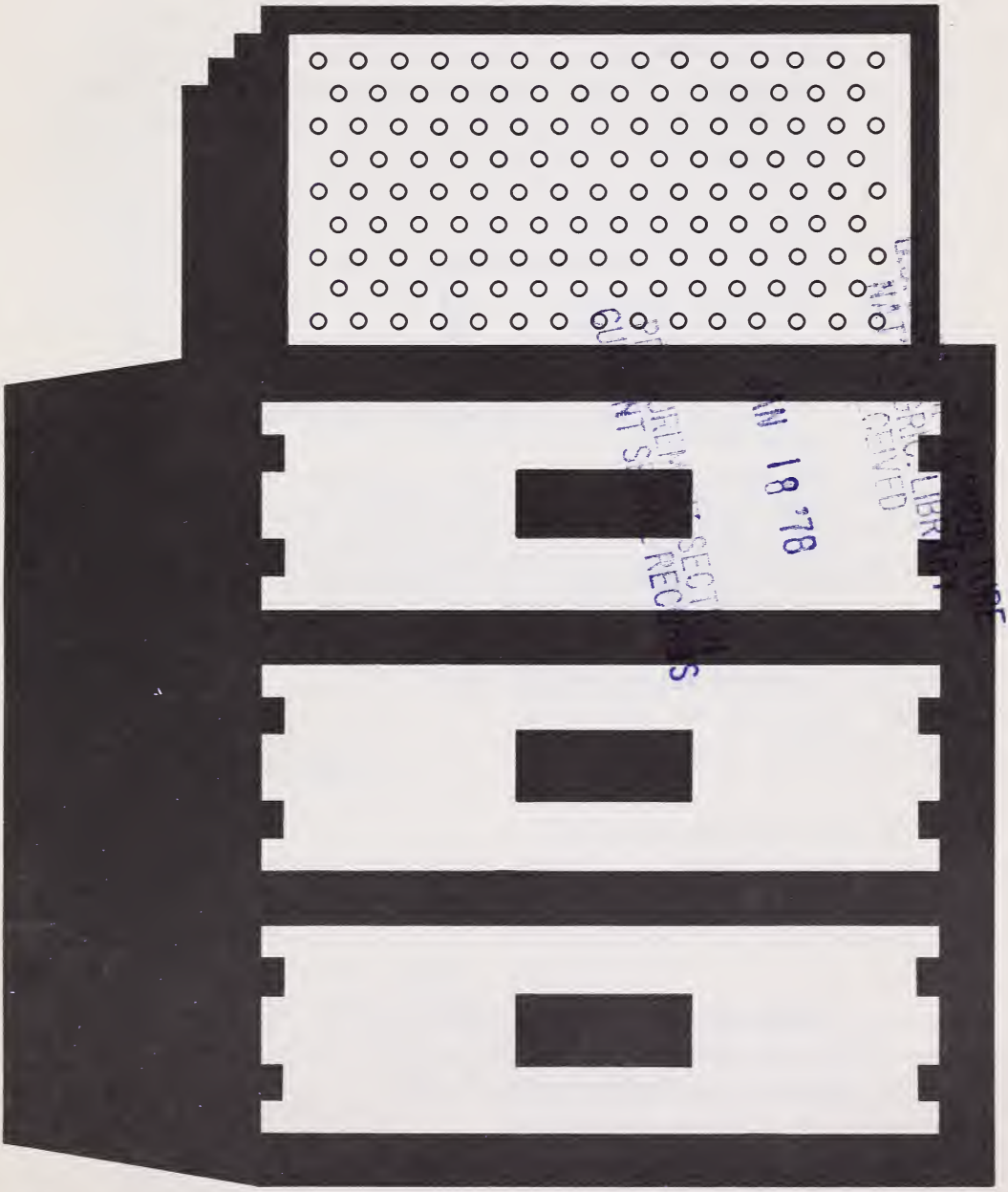
Selecting and Operating Beekeeping Equipment



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CONTENTS

	Page
Equipment for the honey house	3
Handling supers	3
Uncapping	5
Extracting	6
Sump and pump	8
Cleaning	11
Heating and cooling	12
Recovering honey from cappings	14
Storage and shipment	16
Planning the honey house	17
Floor plan	17
Space for supers	18
Truck area	19
Hot room	19
Heat source	20
Other features	20
Equipment for the apiary	21
Moving hives and supers	21
Moving colonies	22
Removing bees from filled supers	24

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selecting and operating

BEEKEEPING EQUIPMENT

By Charles D. Owens and Benjamin F. Detroy, *ARS agricultural engineers*[1]

To be successful in his business of producing bulk honey, a beekeeper must be an efficient manager. He must make sure that the honey house is designed for the work to be done in it, and that it is properly equipped. By wise selection of commercially available equipment, he can reduce labor, production time, and costs.

Because of differences in the size of beekeeping enterprises and in details of operation, beekeepers have individual problems. Some may need equipment that is not available from suppliers. Usually it is possible for them to build the equipment themselves.

EQUIPMENT FOR THE HONEY HOUSE

The main items of equipment needed in the honey house are those used in handling supers, uncapping, extracting, cleaning and clarifying, heating and cooling, wax and honey separation, and bulk handling of honey.

Handling Supers

Moving Supers

Numerous devices are available for moving supers in the honey house. They include—

- Handtrucks. (Some handtrucks also function as lifting devices.)
- Motorized trucks.
- Dollies with casters.

A handtruck (fig. 1) can be used to move single stacks of supers. The supers should be stacked on skid boards so they can be picked up with the truck.

If you have large numbers of supers to be moved, a motorized truck may be warranted. Motorized trucks are available in several sizes.

Dollies with casters (fig. 2) supplement a truck. Supers are unloaded from the truck to the dollies and moved to the uncapping machine.

Dollies or skid boards used in a hot room should have an open platform to allow circulation of air through the stacks. An open platform can be made so that the super rim fits on the frame. If supports are provided under the frame, a metal sheet can be slid under the frame to form the drip pan. When the stacks are in the hot room, the

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Figure 1.—A two-wheeled handtruck is a versatile piece of equipment around the honey house. The one shown here is being used to move empty supers.

drip pan should be removed to allow circulation of air through the stacks.

Pallets and Drip Trays

Equipment for handling pallets can be obtained from suppliers of beekeeping equipment. This equipment is for single stacks. Equipment for handling up to four stacks can be obtained from suppliers of industrial trucks.

Skid boards and pallets can be used on the truck and therefore have an advantage over dollies, which are difficult to hold on the truck without special devices.

Drip trays are useful in the honey house and on trucks. In the honey house they are placed under supers to keep honey from dripping on the floor. On the bed of a truck, they keep the bed clean. If you move stacks one at a time with a handtruck, make a tray to hold individual stacks. If you move them with a warehouse truck, make trays that will each hold two or four stacks.

Lift Tables

A considerable amount of labor can be saved at the uncapping center if lift tables (fig. 3) are used to keep the supers at a convenient working level at all times. Supers are usually stacked on these tables so that the top one is at working height. After the top super has been emptied and removed, the stack is raised until the next super is at the desired height. The process of removing the top super and raising the stack is continued until the last super in the stack is emptied.

Lifting units of various types are available from suppliers of beekeeping equipment. At least one model can be used as a handtruck.

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Figure 2.—Dollies with casters are useful for moving filled supers in the honey house.

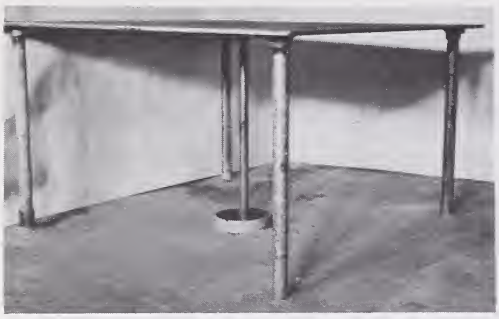

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***Figure 3.*—The purpose of this hydraulically operated table is to keep supers at a convenient working level. The hydraulic cylinder is mounted below the floor.**

Uncapping

Heated knives, vibrating knives, and semiautomatic machines have been developed to help beekeepers reduce the labor involved in uncapping combs. The more elaborate uncapping machines cost several hundred dollars each.

The extent to which a beekeeper should invest in uncapping equipment depends on the scope of his operation, but the need for efficiency is especially urgent at this early stage of production. Even after prudent investment in an uncapping device—for example, an electrically heated hand knife—a beekeeper is likely to find that uncapping is the most laborious, most time-consuming step in the extracting operation.

Most beekeepers use a hand knife or a hand plane for uncapping (fig. 4). Knives and planes operate more efficiently when heated. Models equipped for automatic heating are on the market. Some are heated by electricity, some by steam. The operator holds a comb in one hand and with the other hand draws the heated knife or plane over the face of the comb.

A power-operated vibrating knife is fastened to a frame by spring steel mounts (fig. 5). It may be mounted in whatever position the operator desires—vertically, horizontally, or in an inclined position. The knife, which in all commercial models is steam heated, vibrates in the direction of its length. To remove cappings, the operator draws the face of the combs across the knife.

Several types of semiautomatic uncapping machines are available. Some are equipped with rotary knives and some with vibrating knives that cut in a straight line (fig. 6). Rotary knives use force, not heat, to cut the cappings and to keep the knives free of cappings. Vibrating knives are heated.

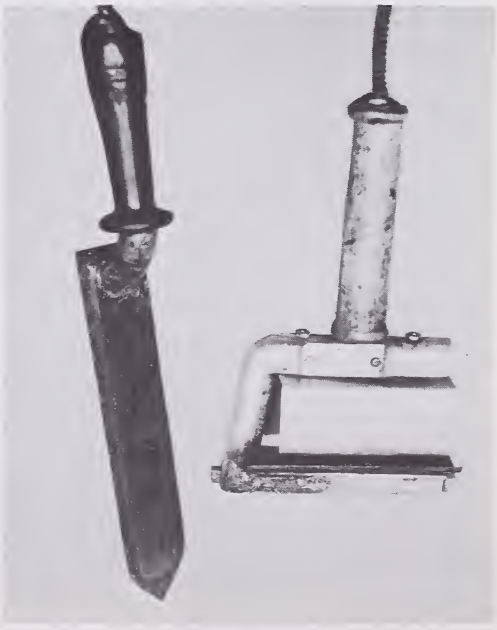

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***Figure 4.*—Electrically heated uncapping devices: Left, hand knife; right, hand plane.**

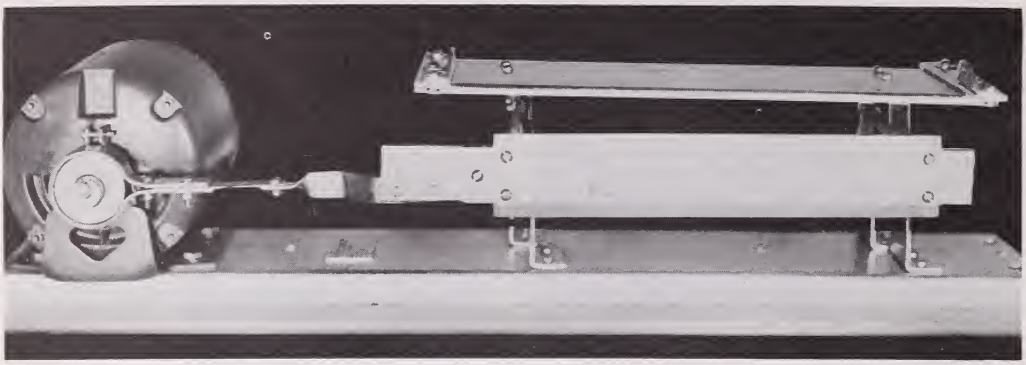

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Figure 5.—**This horizontal vibrating uncapping knife is power operated. Knives are usually steam heated.**

Frames are uncapped mechanically after being fed into the machine by hand. They are then delivered to a collecting unit or are removed from the machine by hand. If frames are delivered to a collecting unit, the uncapped combs are carried on a set of chains and allowed to drain. When the number of combs on the chains is sufficient to load an extractor, they are transferred to the extractor by hand.

A power uncapper makes the uncapping task less fatiguing; it may not increase the speed with which it is accomplished. An unskilled operator can uncap faster with a machine than by hand. But a person who is skilled in uncapping by hand can accomplish as much—until he becomes fatigued—as he can with a machine. A person uncapping by hand must have considerable manual strength to keep pace with a power uncapper over a long period. Thus, machines are preferred if the uncapping is done by women.

Extracting

After combs are uncapped, they are placed on a holding device or delivered to a collecting unit.

The device for holding the combs could be a reel or a rack over a tank, which may be part of the uncapping machine or part of the unit that holds the cappings. In either case, the honey drippings from the uncapped combs are collected and delivered to the sump. (In a small operation, it is satisfactory to place the combs directly into an extractor after uncapping. This procedure is uneconomical in larger operations, because it requires two extractors—while one is extracting, the other is being filled. The second extractor is an unnecessary expense.)

There are two types of extracting machines—the radial and the reversible basket. Both extract the honey by centrifugal force.

A radial extractor starts at a speed of 150 r.p.m. and reaches a maximum speed of 300 r.p.m. Both sides of the comb are extracted simultaneously and the extracting cycle requires 12 to 20 minutes.

Radial extractors range in size from those that accommodate 12 frames per load to those that accommodate 50 frames.

A reversible-basket extractor is equipped with at least two baskets

that support the combs during the extracting cycle. During the extracting cycle, centrifugal force acts on one side of the comb, then on the other; the baskets are reversed three or four times—turned 180°—until both sides of the comb are completely extracted. The extracting time ranges from 2 to 4 minutes at a constant speed.

Reversible-basket extractors range in size from those that accommodate 2 frames per load to those that accommodate 16 frames. In most situations, the four- or

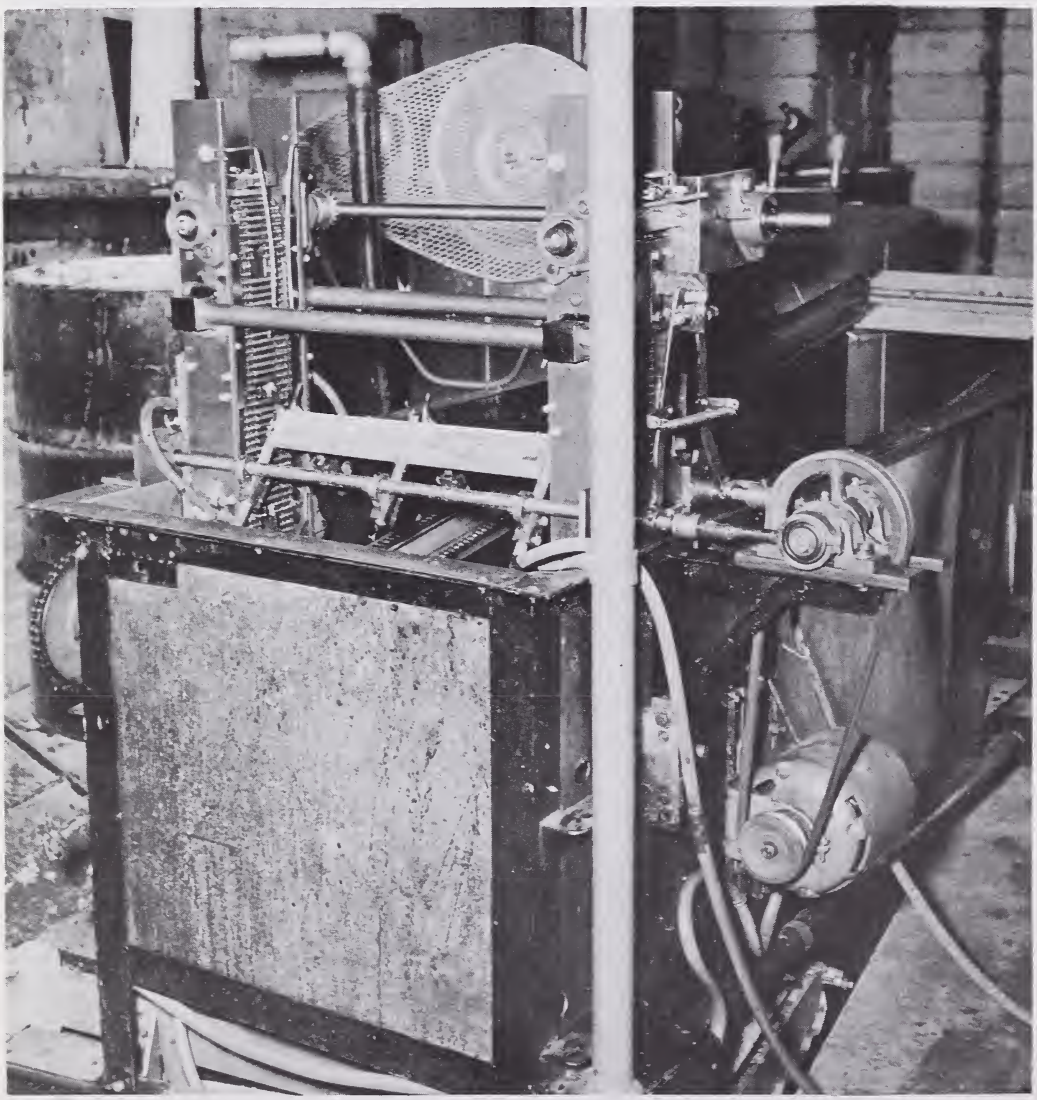

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Figure 6.—**One type of semiautomatic uncapper. After frames of honey are inserted between the guide fingers, they are automatically pulled downward between two vibrating uncapping knives. Uncapped frames are then conveyed over a drip tank.**

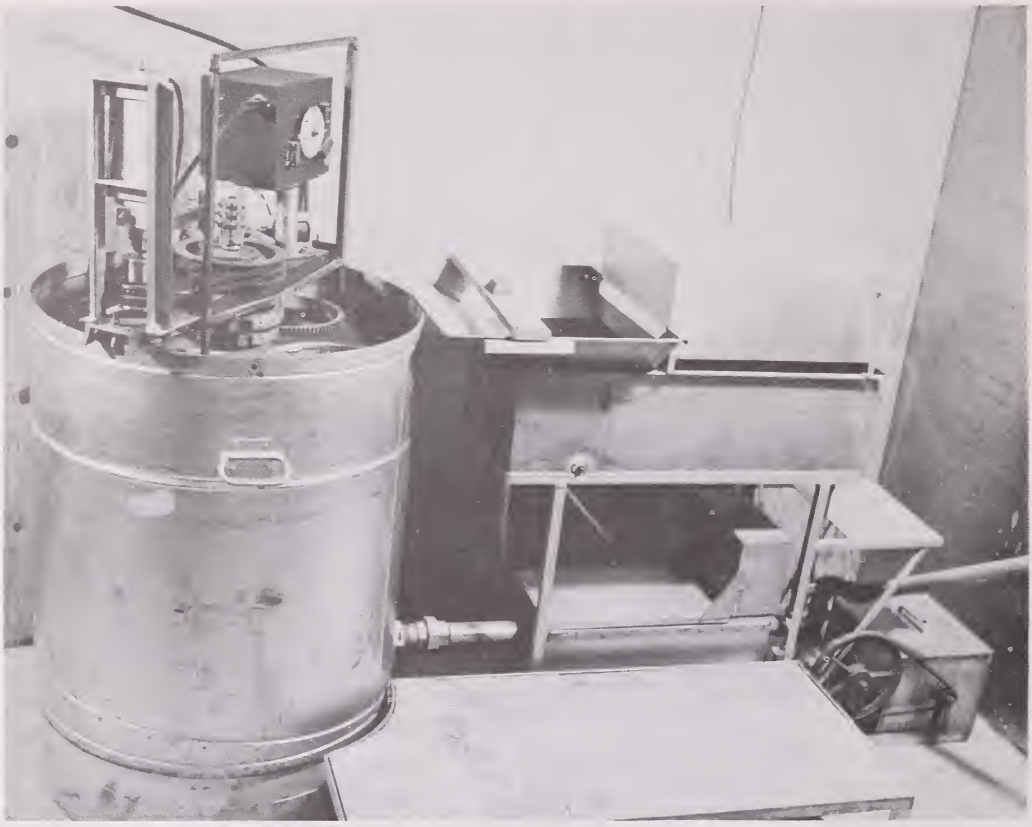

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Figure 7.—**A small extracting setup consisting of a four-frame reversible-basket extractor with automatic control, melter with heat lamps, and sump with float control for the pump motor.**

eight-frame size is preferred (fig. 7). An extractor of more than eight-frame size is undesirable in a portable extracting plant because of the limited space.

Theoretically, it is necessary to have only 3 supers in a portable plant at one time if a reversible-basket machine is used, whereas 6 to 15 supers are necessary for continuous operation of a radial machine. Fewer supers in the plant means that space is made available for other extracting equipment or for honey storage.

Automatic controls (figs. 8 and 9) relieve the operator of all tasks except loading, starting the machine, and unloading. These controls change the extractor speed during the extracting cycle, reverse the basket (reversible-basket extractor), and shut off the motor when the cycle is completed.

Sump and Pump

Honey flows from the uncapping and extracting operations into a collecting tank, called a sump. The main function of the sump in a continuous-flow system is to maintain

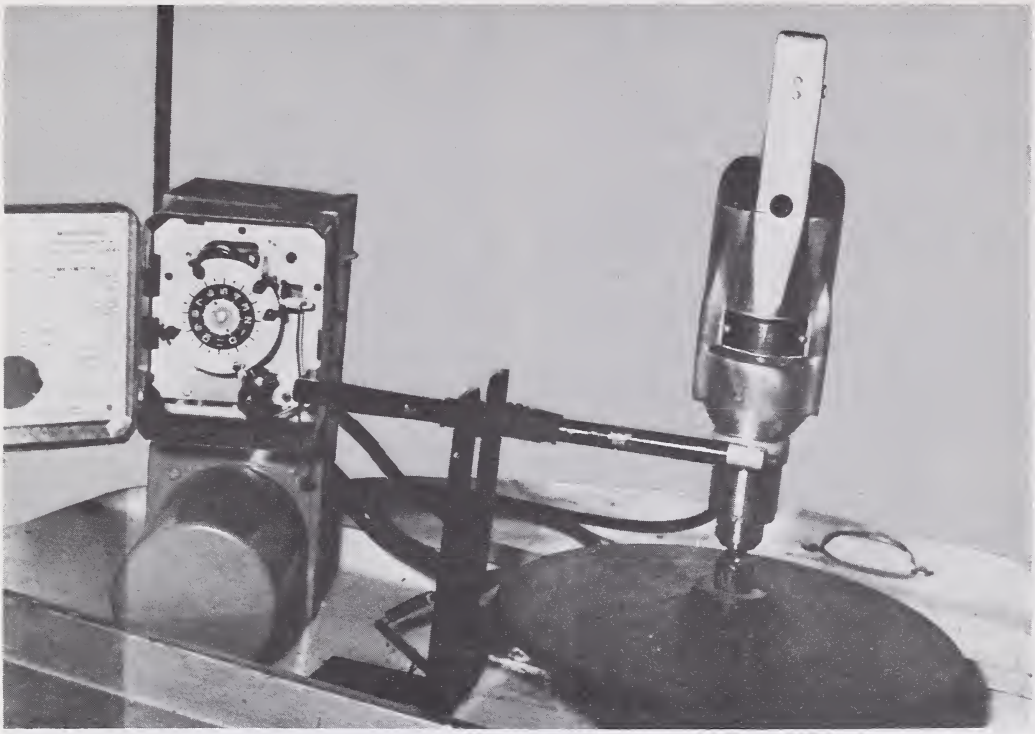

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Figure 8.—Automatic control for a radial extractor.

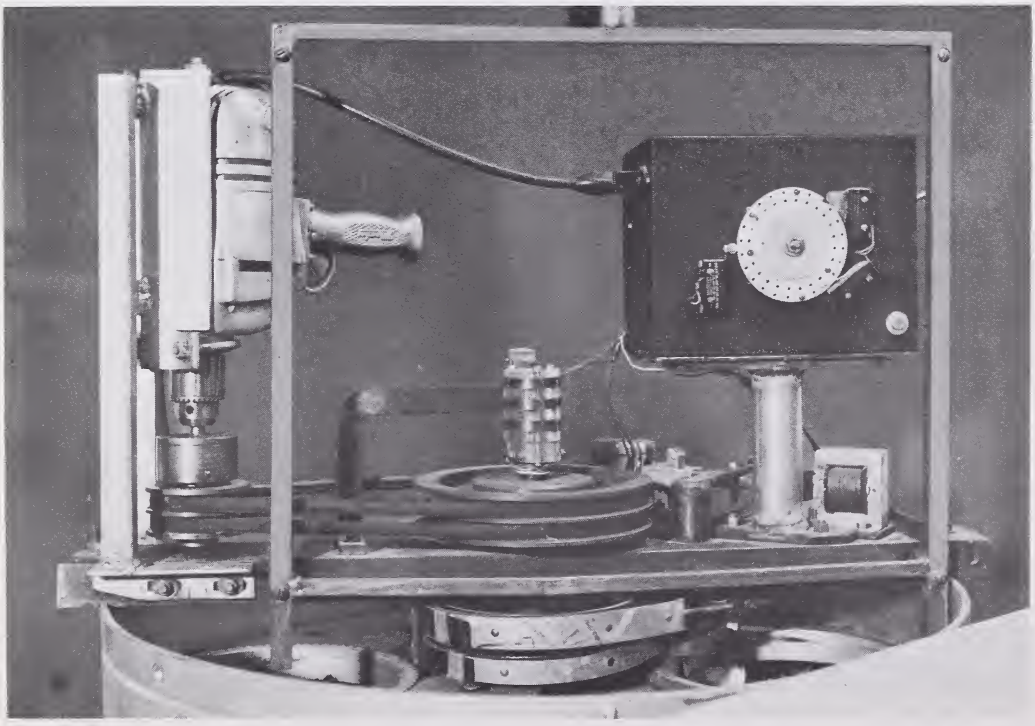

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Figure 9.—Experimental model of an automatic control for a reversible-basket extractor. The model was developed by the U.S. Department of Agriculture.

a constant supply of honey for the conditioning equipment. The extractor cannot perform this function, because the flow of honey from the extractor is irregular.

The sump also acts as a collecting unit in other systems. The pump is started when the sump is full and continues to operate until the honey is down to the pump intake. The pump motor is shut off and is idle until the sump is again full.

A sump usually contains a series of screens or baffles (or both) for removing most of the coarse particles of wax and other foreign material from the honey. It may have an exterior water jacket in which the temperature of the water is maintained at 120° to 140° F. to facilitate pumping or gravity flow.

In a very simple production setup, a pump is not necessary—gravity performs its functions. But in most honey houses, a pump is necessary for moving honey through the heating and cooling units, and may be needed in straining; the role of gravity is limited to filling and emptying storage tanks.

The gear pump (fig. 10) and the vane pump are the most common types. If the pump is part of a continuous-flow system, it should be

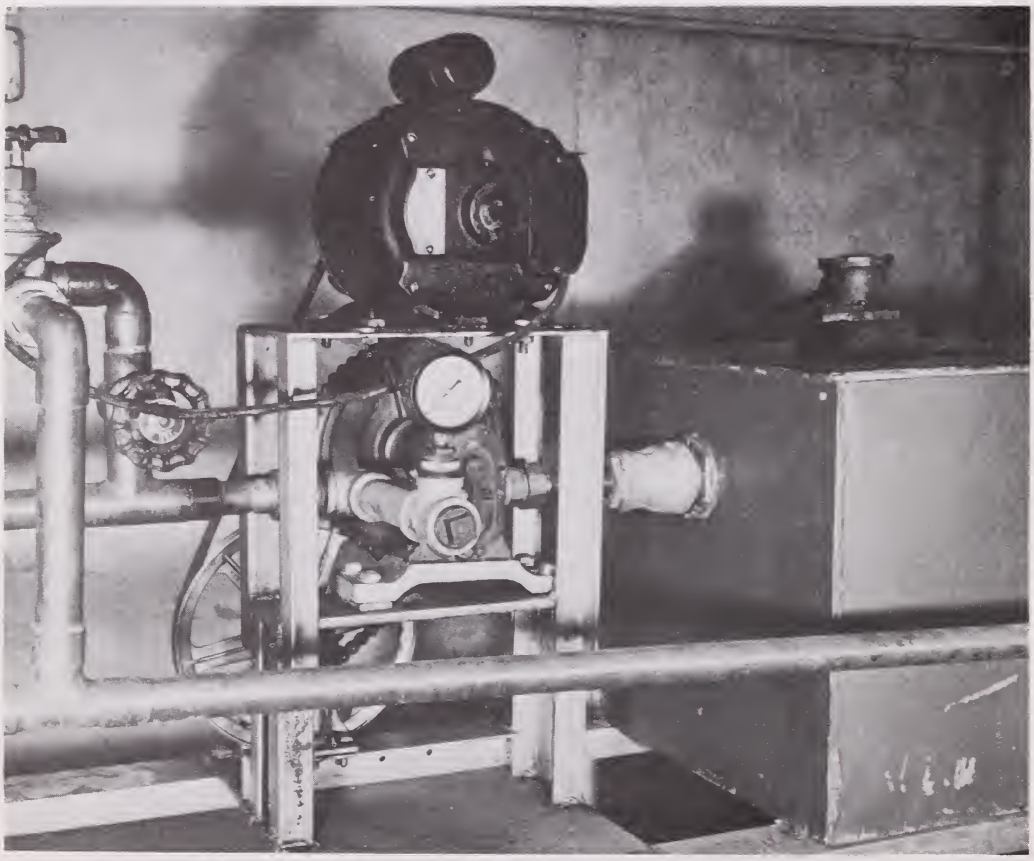

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Figure 10.—**Automatic sump pump. The motor-driven gear pump is automatically controlled by an electric liquid-level control mounted in the top of the sump.**

supplied with honey in sufficient quantities to allow uninterrupted operation. Other systems require pump operation only long enough to move a given quantity of collected honey.

To prevent introduction of air into the honey, run the pump at low speed and keep the level of the honey in the sump well above the pump intake.

The sump should be equipped with a float switch that will start and stop the pump motor automatically.

A continuous-flow system should include a pressure switch in the honey line (fig. 11). Its purpose is to stop the pump motor if excessive pressure develops in the line. High line pressure should be avoided in the interest of protecting equipment in the conditioning system.

Cleaning

To meet U.S. Department of Agriculture grade A standards, extracted honey must be free of foreign particles that are removable by a standard No. 80 sieve at a honey temperature of 130° F.

Honey may be cleaned by flotation or by straining. In the flotation process, liquid honey is pumped, or flows by gravity, into settling tanks. Particles of wax and other foreign material less dense than the honey rise to the top of the tank and are skimmed off; the honey is then drawn from the bottom of the tank. When drawing off honey, the operator should leave the top layer in the tank; it may contain foreign particles.

Strainers are available from suppliers in a wide variety of shapes and sizes, and many types have been constructed by beekeepers to meet their individual needs. The honey is moved through the strainer by pressure (pumping) or by gravity flow.

Ease of cleaning the straining material is an important consideration in selecting a strainer. The material may be metal screen, layers of silica sand, or cloth.

To be efficient, screens must be of fine mesh. They are very difficult to clean when they become plugged with particles of wax.

Silica sand is also difficult to clean. Another disadvantage is that after the sand is washed it contains a large amount of water. Before the sand is reused, the water must be removed to keep it from being added to the honey.

Cloth is easier to clean than the other materials, and since the initial cost is low it may be discarded when cleaning becomes difficult. The chief disadvantage of cloth is its inability to withstand strong pressure. Cloth requires more frequent cleaning when used in a pressure unit than when used in a gravity unit; the cleanings are necessary to prevent an increase in line pressure that would rupture the cloth.

In one type of strainer the straining material consists of a cylindrical rotating metal screen, one end of which is slightly elevated. Honey and wax are fed into the cylinder at the elevated end. Wax particles adhere to each other and form a roll, which helps to knead the honey through the screen. The honey is

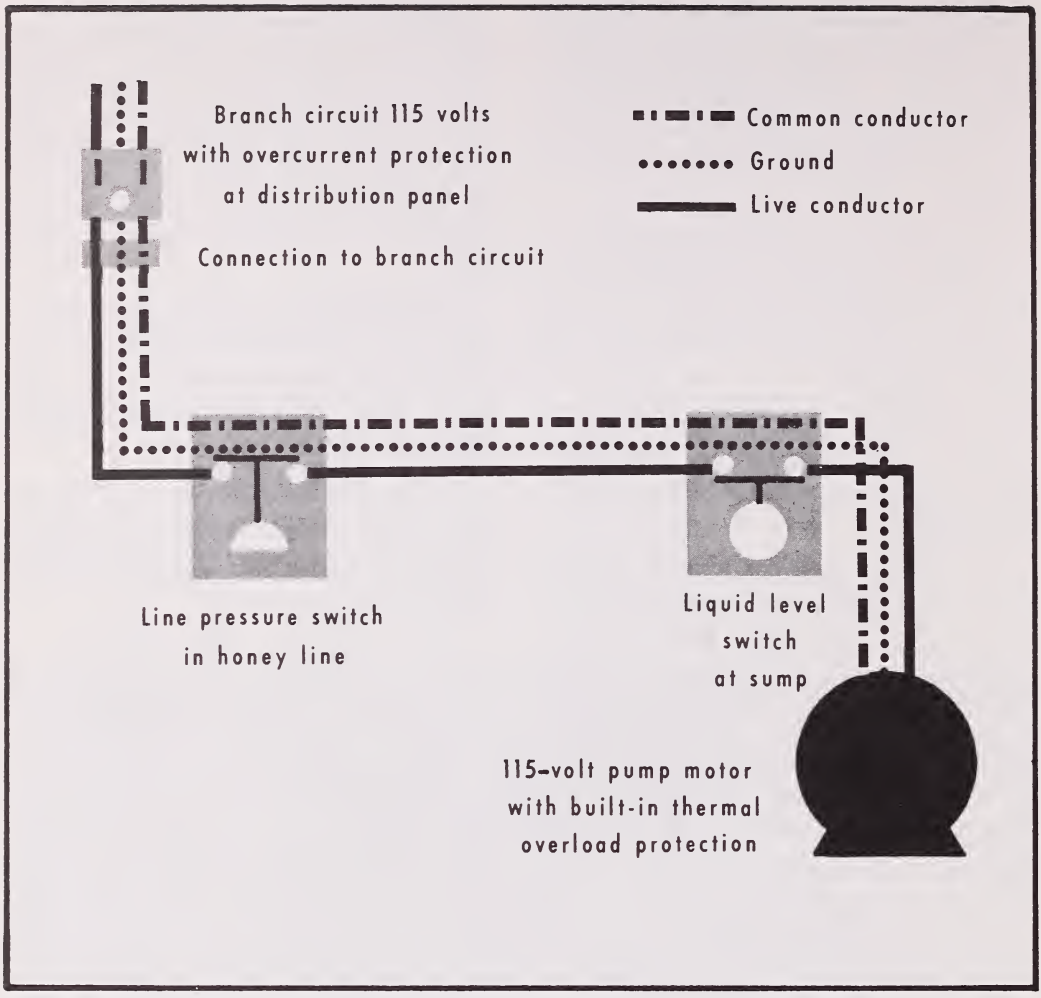

***Figure 11.*—Wiring diagram for pump control.**

collected in a tank beneath the screen, and the wax is discharged from the lower end of the screen cylinder. The manufacturer guarantees an output of 500 pounds of honey per hour if a 30-mesh screen is used and if the honey being strained was uncapped with a hand knife or vibrating knife. With a 50-mesh screen, output is reduced by one-half.

Where consistently large quantities of honey are to be strained, continuous operation is desirable. This is made possible by alternate operation of two strainers; while one is idle for cleaning, the other is in service.

Heating and Cooling

Straining is facilitated if the honey temperature is between 100° and 120° F. But honey ahead of a strainer should not have a temperature above 120°. Such a temperature softens the wax particles, and soft particles are hard to remove

with a strainer because they are forced into or through the small openings. After the honey has been strained, it must be heated to a higher temperature to prevent fermentation and to retard crystallization.

Improper heating with insufficient cooling causes honey to darken and impairs the flavor. It is especially important to guard against overheating.

Before honey is strained, it can be heated by passing it through a double-jacket tank (with baffle), or by passing it over a heated shallow pan with corrugated bottom, or by passing it through a heat exchanger designed for heating honey. The first method of heating is used most extensively. If the honey is to be strained in a continuous-flow system, the heat exchanger should be used.

Any of the three types of heaters used before straining may be used afterwards to apply additional heat to prevent fermentation and to retard crystallization.

A batch heater of the jacketed tank type may also be used for heating honey after straining.

Honey must be stirred while heating or the honey next to the walls will overheat and burn while that in the center will still be cold. Stirring can be performed by hand, but a slow-speed motor-driven agitator is best. (It is always necessary to stir honey that is held in a container for heating.)

Heat exchangers of modern design are shown in figure 12. Each of the tubes contains a honey channel three-sixteenths inch thick. The

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***Figure 12.*—Concentric tube heat exchangers and gravel strainers used in a continuous-flow honey-conditioning system.**

channel is between two layers of flowing hot water. Honey is pumped through the channel in a direction opposite to the direction of the flow of water. These units can be connected in series so that the honey is in the heating channel for sufficient time to raise it to the desired temperature. The temperature of the water supply should be maintained at 180° to 190° F. to raise the honey temperature quickly

with a minimum number of heat exchangers.

Four procedures for heating liquid honey, and for cooling it, are suggested below. Follow the procedure that is best suited to your equipment.

1. Heat rapidly to 160° F. Total heating time should not exceed 10 minutes. Heat exchangers should be used. Begin cooling immediately after heating; cool to 100° or less; complete cooling in 5 minutes or less.

2. Heat to 140° in not more than 10 minutes; hold 30 minutes; cool to 100° or less in not more than 10 minutes. (If heating requires more than 10 minutes, decrease hold time accordingly.)

3. If cooling facilities are not available and heated honey is to be placed in containers of less than 60-pound capacity, heat to 120° to 130°. The time required for heating is not critical.

4. If cooling facilities are not available and heated honey is to be placed in 60-pound cans, in drums, or in large tanks, heat to 120° or less. The time required for heating is not critical.

In both heatings (before and after straining), the heating agent should be hot water—not steam. With hot water as the agent, it is easy to control the amount of heat added; with steam, overheating would be a danger.

The hot water may be introduced into the heating units from electric water heaters or from a central heating plant, or electric immersion heaters may be installed in the units.

Beekeepers must devise their own cooling systems, or strive to get maximum performance from those that they purchase; no fully satisfactory equipment is available. In small operations, cooling pans and devices similar to heating units, but containing cold water, are practicable aids in cooling honey.

Recovering Honey From Cappings

Cappings accumulated in the uncapping of combs contain honey, and the beekeeper has the task of recovering the honey without impairing its flavor or color. The following methods are used:

1. *Draining, followed by melting or pressing.*—The combs are uncapped into wire baskets, or into perforated sheet-metal baskets, which hold the cappings until most of the honey is drained off.

After the cappings have drained, some honey remains in them; this is recovered by melting or pressing the cappings. The drained cappings may be melted in a solar melter or double boiler, or pressed with a wax press. If reinforced perforated sheet-metal baskets are used, pressure can be applied to the cappings with a hydraulic or mechanical jack.

2. *Flotation.*—A type of cappings melter available from suppliers of beekeeping equipment separates honey from cappings by flotation. The cappings containing honey enter the melter tank beneath a steam-heated coil. The honey

and wax separate by gravity. The separation is facilitated by heat, which softens the cappings and increases the fluidity of the honey. The wax, being less dense than the honey, rises to the top where it is melted by heat from the steam coil. The honey level, which is controlled by an adjustable height overflow enclosed by a baffle to prevent the entry of wax, is maintained at least 2 inches below the steam coil. A layer of wax in various stages of liquefaction is maintained between the honey level and the top of the steam coil by a wax discharge opening. As the wax from the cappings rises toward the steam coil from underneath, liquid wax flows out the discharge into a solidifying container. The honey flows out the overflow into a pipe leading to the honey sump.

Slumgum (residue consisting of cocoons, propolis, and other foreign material) should be removed regularly; it acts as an insulator and reduces the effectiveness of the heating coils.

3. *Centrifuging.*—Honey is separated from cappings by centrifugal, or whirldry, extractors. These are radial extractors that have reels with solid bottoms and perforated steel sides. Centrifugal separating units can be purchased, or radial extractors can be converted to centrifugal units by fitting them with wire baskets into which the cappings are placed.

A spin-float centrifugal honey-wax separator is available commercially that has high capacity and can be used in a continuous flow extracting system.

Centrifuging is usually faster, and produces drier cappings, than draining, but after each one it is necessary to melt the wax to salvage the remaining honey. Honey obtained by melting the wax after draining or centrifuging (or by flotation if proper precautions are not taken) is usually dark and off flavor. It may be used for spring feeding of bees where spreading of bee diseases is not a problem.

●

A person who wishes to use the flotation method and does not have a regular source of steam heat for heating the coils can melt the cappings with electric heat lamps (fig. 13). These lamps should be placed 7 inches above the wax level in the melter tank. When the melter is started in the morning, it is necessary to melt a solidified wax bed. For this, 5 or more watts per square inch of melter surface are required.

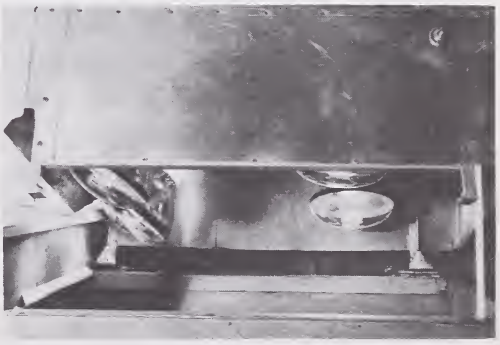

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Figure 13.—Four heat lamps, 250 watts each, used as heat source for a wax melter. The lamps have special glass to prevent breakage when splashing liquids strike them.

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***Figure 14.*—Solar wax melter with cabinet for enclosing wax pail. Baffles on melter floor prevent chunks of wax from sliding to the front.**

For melting wax after the solidified wax bed has been melted and while uncapping is in progress, 2 or 3 watts per square inch of melter surface are required.

●

A solar wax melter, for melting cappings and old combs, is useful in any honey house, and it eliminates the fire hazard that is present when wax is melted by direct heat.

Melters of this type range in size from 1½ by 3 feet to 2½ by 14 feet. The melter shown in figure 14 has inside dimensions of 37½ inches by 55 inches.

The following suggestions are for beekeepers who wish to make solar wax melters:

- The melter should be large enough to accommodate the volume of wax that would be placed in it in one day.
- It should be made of aluminum, stainless steel, or copper sheet, to prevent darkening the wax.
- It should be shallow—about 5 inches deep—to prevent shadows on the melting area.
- It should have a double-glass cover, and the space between the two pieces of glass should be one-half inch to 1 inch.
- It should be tight enough to keep out bees.
- The sides and bottom should be insulated.
- The drain should be screened to prevent slumgum from leaving the melter with the honey and molten wax.

●

Wax presses are used to recover wax from slumgum. Since presses are among the more expensive pieces of beekeeping equipment, a small operator may decide to have his wax rendering done by a commercial plant. But if he makes this decision, he should melt down old combs and cappings as they accumulate. A solar wax melter is recommended for this purpose. If the combs and cappings are not melted down, they may be destroyed by wax moths.

Do not discard the slumgum. At least half of its weight is wax, and commercial rendering plants can recover the wax at a low cost.

Storage and Shipment

After honey has been conditioned, it is run into large storage tanks, which may also be used as settling tanks. From the storage tanks it is transferred to containers for shipment to the packer.

Containers may be 5-gallon (60-pound) cans or 55-gallon drums. Choice between cans and drums depends on the facilities that you have for moving containers and on the floor space available for them before they are shipped.

For moving a large number of cans, you need caster dollies, hand trucks, or a motor-driven lift truck (fig. 15). If drums are used, it will probably be necessary to stack them to conserve floorspace; for this you will need a hoist or a motor-driven lift truck. A barrel truck (a hand truck of special design for handling barrels) is satisfactory for moving drums across the floor, but not for stacking them.

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Figure 15.—**This motor-driven lift truck is moving sixteen 60-pound cans of honey. Attachments for handling barrels and drums are available.**

PLANNING THE HONEY HOUSE

The operations necessary in extracting honey, and the sequence in which they are performed, are shown in figure 16. All these operations take place in the honey house.

If you are planning to build a honey house, consider the possibility of having two stories—or one story and a basement. The advantage of a two-level structure is that much of the honey can be moved by gravity, and this reduces the need for pumping equipment.

If there is a basement, it should have a ground-level entrance; whether this is possible depends on the terrain.

Floor Plan

Before you can make detailed plans for a honey house, you must—

- Decide what methods you intend to follow in performing the major operations of honey extraction.
- Select equipment suited to these methods.

In deciding on methods, you will be influenced by the size of your beekeeping enterprise. Whether the methods are simple or complex, they should form a coordinated system.

When you have worked out a system and selected the appropriate equipment, you can make a honey house floor plan showing the location of the equipment.

A good procedure is to make a scale templet of each piece of equipment and arrange the templets on the floor plan. By moving the templets, you can study various layouts.

By using string to represent distances covered by the operator in

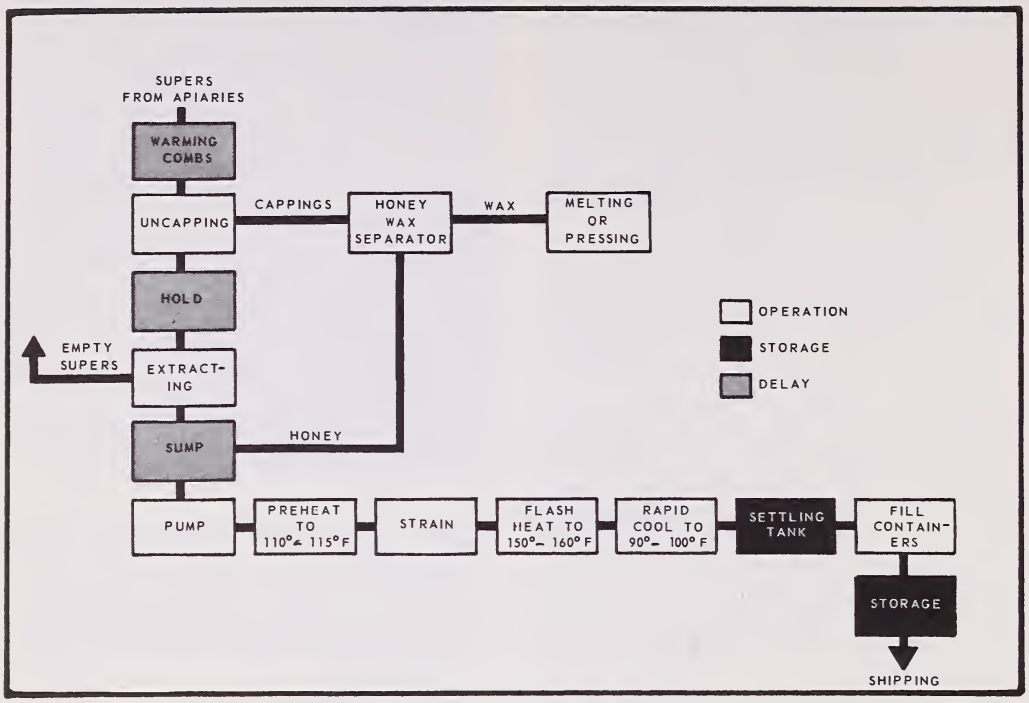

***Figure 16.*—Flow diagram showing operations necessary in extracting honey.**

walking from one area to another, you can tell how layouts compare in the amount of walking they would require.

The floor plan shown in figure 17 is one of many possibilities. As an aid to planning, it is useful chiefly because it includes all the areas needed in a honey house and shows in proper proportion the amount of space that should be allotted to each.

Space for Supers

The estimate of space to be occupied by supers during extraction should be based on the maximum number of supers that will be in the extracting area at any one time. In determining this number, allow for increases in colonies and for occasions when more than the normal number of supers must be held in the area.

Portable Extracting Unit

Where the apiary is more than 25 miles from the honey house, the use of a portable extracting unit should be considered. The honey can be extracted in the yards and hauled to the central area for processing.

Honey can be extracted efficiently with electrical equipment in a portable extracting unit; it is necessary to have a generator.

Positioning of the various items of equipment should be given the same consideration that would be given to equipment installed in a honey house.

The estimate of space for storage of supers (full or empty) should be based on the normal stack height used at the uncapper or stack height used on the truck.

The work of handling supers is reduced if stacks of uniform height are used throughout the operation.

Truck Area

The truck area, which must be enclosed to keep out robber bees, may be in the main building or in a wing. If it is in the center of the main building, one side can be next to the extracting plant and the other side next to storage (fig. 17).

As the truck stands at the loading (or unloading) platform, the bed should be level with the platform. Build the platform to truck-bed height or make a sunken driveway for the truck.

Hot Room

All extracting operations are made easier if the combs are at a temperature of 85° to 100° F. when the honey is extracted. Honey houses in the North should include a hot room where combs can be raised to this temperature and held there until extracting time. The hot room should be near the unloading area and the uncapping machine.

As supers are placed in the hot room, they should be stacked criss-

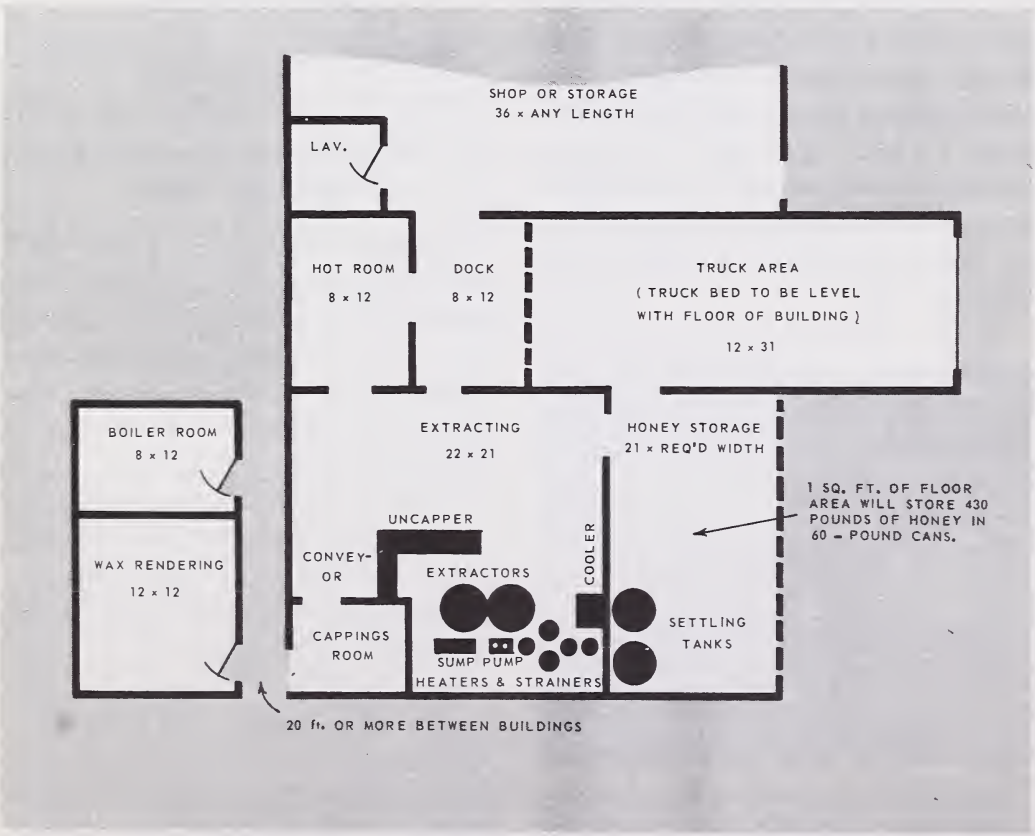

Figure 17.—**Floor plan showing all the areas needed in a honey house.**

cross or on slatted pallets. Warm air is then circulated through the supers. (It is blown into the hot room along the floor and is exhausted at the ceiling.) In this way the temperature of the honey can be raised to the desired level overnight.

The moisture content of the honey can be increased or decreased by controlling the temperature and humidity of the air circulated in the hot room.

The desirable moisture content for honey is 18 percent. Honey having a moisture content of 18 percent and a temperature of 70° F. (room temperature) gains moisture when the relative humidity is greater than 60 percent, and loses moisture when the relative humidity is less than 60 percent. In a climate that is extremely dry or wet, it may be advisable to install humidifying or dehumidifying equipment to help maintain a relative humidity of 60 percent. The equipment may be installed to control the air supplied to the hot room or extracting area.

If the extracting operation is on a small scale, the beekeeper may use the whole extracting area as a hot room during the night, rather than have a separate room.

Heat Source

If heat is required for only one or two uncapping knives and a flotation honey wax separator, electrically heated units are preferred. They can be controlled by thermostats and are easier to use than steam heaters.

Equipment with built-in electric heaters is used for uncapping and for other operations requiring high temperatures. All operations can be electrically heated. If some of the units that you select do not have built-in electric heaters, auxiliary heat lamps or heating elements can be used as a source of heat.

Steam may be more economical than electricity if a large amount of heat is needed—as for a hot room or extracting room, or for heating honey or melting down old combs or cappings. The steam boiler should have automatic controls for safe, efficient operation. Fire hazard is reduced if the steam boiler and the wax rendering equipment are in a separate building.

Other Features

Lighting.—Illumination of 50 to 75 footcandles is needed in areas

Shade and Water

In areas where the daytime temperature is over 95° F., honey bees require shade or water, or both, to keep down the temperature in the hives. When water is needed, the bees collect water at the expense of collecting food.

If the apiary lacks natural shade, and the source of water is a considerable distance away, the beekeeper can increase production by building shades and by placing water nearby.

For further information, see Leaflet 530, "Shade and Water for the Honey Bee Colony," available from the U.S. Department of Agriculture, Washington, D.C. 20250.

where close work is performed—for example, uncapping by hand. The rest of the honey house should have good lighting—illumination of about 25 footcandles. Illumination should be measured with a footcandle meter.

Fire-resistant materials.—Rooms in which fire might originate, such as those containing the furnace and water heaters, should be built of masonry or lined with asbestos board.

Ventilation.—Ventilating fans should be used to reduce odors and lower the humidity.

Floor and walls.—The floor, walls, and ceiling should be made of materials that are easy to clean and easy to maintain. The floor should be smooth and free of vibration.

Pipes.—Pipes carrying honey should be of stainless steel or tinned copper. Other metals may darken the honey.

Bee escapes.—Bee escapes should be placed in windows to reduce the number of bees in the extracting room, and there should be no cracks in the building through which robber bees could enter.

EQUIPMENT FOR THE APIARY

Moving Hives and Supers

Where possible, arrange hives so that you can easily approach them with a truck. By doing this you will greatly reduce the time and labor required in moving hives and in moving supers between hives and the truck.

Maximum efficiency is obtained by placing hives in rows and leveling the ground so a truck can be driven behind the rows.

If the truck arrangement is not possible, plan for access with a handtruck. The handtruck should have large wheels; they make the truck easier to push or pull.

A handtruck equipped with clamps (fig. 18) can be used to move colonies or supers about the yard, or up a ramp for loading onto the truck. It can also be used in the honey house.

One type of handtruck has an engine to drive the wheels. The power feature has a special advantage where it is necessary to move equipment over rough ground or up a ramp.

BN 22123

***Figure 18.*—Handtruck equipped with clamps.**

Moving Colonies

Some beekeepers are obliged to move their colonies frequently to new locations. They are said to be engaged in migratory beekeeping.

Migratory beekeeping is necessary in areas where nectar flows are short or where hives are placed in fields so that the bees will pollinate crops.

Loading and unloading of hives are tasks that must be performed frequently where migratory beekeeping is practiced. Mechanical hoists have been developed for making the tasks easier. With a hoist it is possible for one man to do all the loading and unloading of hives.

The hoist is mounted on the truck frame, and is operated by electric or hydraulic power.

An electrically powered hoist operates from the truck battery or from a gasoline-driven generator mounted in the counterbalance of the boom (fig. 19). A hydraulic hoist operates from the power take-off or from a pump driven by the fan belt.

Some hoists only raise or lower the fork; the operator moves the fork along the boom by hand. Other hoists, in addition to raising and lowering the fork, have automatic boom leveling and power travel for the fork along the boom. In choosing between the two types, consider how much you intend to use a hoist. The first type is less expensive; the second is faster.

A fork picks up one 3-story colony or two 2-story colonies. It may grasp the hives by going under the bottom board. If it is equipped with fingers, it can grasp the bottom hive by the hand holes or by 1½-inch cleats on the ends of the hive bodies.

A hoist can be obtained that will load two, three, or four colonies at

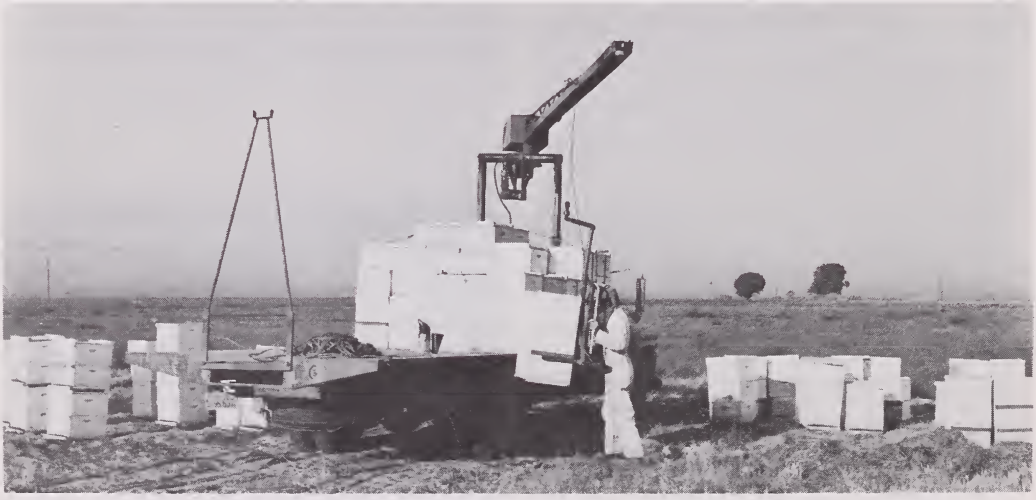

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Figure 19.—**Loading hives with an electrically powered boom loader.**

a time. The colonies are first placed on a pallet and are handled as a unit.

If colonies are to be lifted on pallets, it may be desirable to mount a fork lift on a tractor. A tractor can haul colonies to places that would be difficult to reach with a truck. Also, a tractor equipped with a blade can be used to level the area before the colonies are unloaded.

A disadvantage of a tractor-mounted hoist is that the tractor has to be hauled on a trailer. Where colonies are being placed in a field for pollination purposes, another disadvantage often appears—lack of room for maneuvering a tractor.

If a beekeeper moves his colonies infrequently or has only a few colonies, he can load them on a truck with a hydraulic tailgate (fig. 20). He will find the tailgate useful for loading supers of honey and as a platform on which to stand when working tall hives. The hydraulic system can be powered by the truck engine or by an engine mounted on the truck.

BN 22119

Figure 20.—Loading supers on a truck with a hydraulic tailgate.

Removing Bees From Filled Supers

Filled honey supers removed from a colony must be cleared of bees before the supers are taken into the honey house. Various methods of removing bees may be used, but the most satisfactory is the bee blower. In this method, air is blown at a velocity of approximately 300 feet per second to remove the bees from the supers.

Several kinds of blowers are available. They vary from wheel-mounted to back-pack units. Most are powered by gasoline engines but some have electric motors. Compressors must be large enough to provide an adequate air supply.

BN 32852

***Figure 21.*—Removing bees from filled honey supers with air discharged from a heavy-duty shop-type vacuum cleaner.**

General Principles

In planning the honey house, allow space for installing additional equipment that may be needed in the future.

In selecting equipment, allow for the possibility of expansion. Give particular attention to future need for lighting, power, and ventilation.

All equipment should be of equal capacity. Equipment operates most efficiently at or near its rated capacity.

Select equipment that will permit material to flow from one unit to the next without interruption.

Material should be placed so that it can be moved easily to the next operation.

Machines should be arranged so that the operator can transfer material to or from them by taking only a few steps.

The operator should not have to wait by a machine when it does not require his attention.

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